BEACON WIND FOUNDATION TESTING
REVISED BIOLOGICAL ASSESSMENT

Proposed Project

The Bureau of Ocean Energy Management (BOEM) is reviewing the Site Assessment Plan (SAP) amendment submitted by Beacon Wind to conduct foundation testing in Lease Area OCS-A 0520 (Lease Area) as part of Beacon Wind's site assessment activities. If BOEM approves the SAP amendment, Beacon Wind would be authorized to carry out the foundation testing, as described below. The purpose of the foundation testing is to collect site-specific data during installation and removal of a single suction bucket foundation at up to 26 locations within the Lease Area. The foundation tests are necessary to assess site conditions and gather information to support engineering design of foundations for wind turbine generators and offshore substations in support of the construction and operations plan for the Beacon Wind project.

The proposed foundation testing includes the installation and removal of a single steel suction bucket foundation at up to 26 sites within the Lease Area (**Figure 1, Table 1**). Multiple suction bucket tests are anticipated at some of the 26 sites, resulting in a total of 35 tests. Each test site (i.e., the area in which testing activities would occur) would be a 984 by 984-foott (300 by 300-meter) area centered on a proposed location for wind turbine generator installation in the Lease Area. Foundation testing activities would not disturb the entire test site, but all benthic-disturbing activities would occur within the site. For each test, the suction bucket foundation would be installed and removed once over a period of approximately six to nine hours (three to five hours for installation and three to four hours for removal). In total, foundation testing at all 26 locations is planned to be conducted over a period of 10 to 15 days, plus additional days for inclement weather or other potential delays. Foundation testing activities could occur at any time within a 24-hour period. Foundation testing could begin as early as July 2024, pending agency approval, and would be completed no later than July 2026.

For each test, a steel reference frame would be lowered to the seabed prior to installation of the suction bucket foundation, where it would remain stationary for the duration of the test. The reference frame would be used to assist with the placement of the foundation onto the targeted location, ensuring accurate positioning of the suction bucket. The footprint of the frame would be approximately 11 square feet (one square meter). Studs at the edge of the reference frame may penetrate approximately 2 inches (5 centimeters) into the seabed. No anchoring would occur, and structure would temporary and would be removed after the completion of each test.

Once the reference frame is in place, the suction bucket would be lowered into place at a rate of approximately 13 inches (30 centimeters) per second (0.7 miles [1.1 kilometers] per hour) or less. The suction bucket would be 36 to 39 feet (11 to 12 meters) in height with a diameter of 30 to 39 feet (9 to 12 meters) and a thickness of 2 to 2.8 inches (5 to 7 centimeters), with a footprint of 1,195 square feet (111 square meters). The foundation would weigh approximately 200 tons (181 metric tons) and would be designed to penetrate 33 to 39 feet (10 to 12 meters) into the seabed. Up to two remotely-operated vehicles (ROVs), which would be operated from the foundation testing vessel, may be used to assist in positioning the suction bucket. After the suction bucket has settled into the sediment, a low-flow suction pump mounted to the top of the bucket would remove water from within the bucket, creating an area of reduced pressure that would assist in installing the suction bucket to the target penetration depth. The pump is expected to operate at an estimated mean distance above the seabed of 19 feet (6 meters) and at a typical flow rate of approximately 1,320 gallons per minute (5 cubic meters per minute), with a pump velocity of 5.2 feet per second (1.6 meters per second) and a maximum intake diameter of 7 inches (18 centimeters) while pumping water from the water column into the suction bucket. The suction pump would not be screened to avoid potential pressure losses due to clogging of the screen (e.g., if a small piece of debris became suctioned to the screen), which would cause the pump to malfunction. Although the intake would be open, the single opening is localized and small enough to pose a negligible risk of impingement or entrapment of any listed species.

In total up to 1,775 cubic yards (1,357 cubic meters) of water may be removed from inside the suction bucket and released into the water column immediately outside the bucket. The hydraulic zone of influence of the pump, defined as area in the water column that would experience an increased flow velocity of greater than 10 percent towards the intake, is expected to be up to 20 square feet.[1] The suction pump would generate noise during operation, but observations conducted at other OSW facilities suggest that noise from suction pumps would attenuate to background noise levels at a relatively short distance from the pump. At the Borkum Riffgrund 2 wind farm in the North Sea, where the background noise level was 137 decibels referenced to 1 micropascal (dB re 1 µPa), noise from the suction pumps could not be measured beyond 1,640 feet (500 meters) from the pumps (Koschinski and Lüdemann 2020).

During installation of the suction bucket, imaging equipment mounted inside the top of the suction bucket would be used to monitor the soil plug and to gather data to be used in refinement of foundation engineering for the Beacon Wind project. Imaging equipment may include sonar and/or an echosounder. The sonar would be operated at frequencies of 600 to 900 kilohertz, and the echosounder would be operated at 400 to 600 kilohertz. The ROV(s) may also be used to observe and gather data on the penetration process during installation. Additionally, Beacon Wind would conduct acoustic monitoring to document sound levels produced during suction bucket installation. The acoustic monitoring would utilize three baseplate moorings, deployed on the seabed at various distances from the suction bucket. This bottom-mounted system would avoid noise introduced by water flow past the instrument. Each baseplate mooring would be approximately 3.3 feet (1 meter) long, 1.6 feet (0.5 meter) wide, and 3.3 feet (1 meter) high. All three moorings would be retrieved using an ROV at the completion of each monitored test and deployed at the next testing site for acoustic monitoring.

After installation has been completed and the necessary information has been gathered as described above (e.g., soil plug information gathered via internal imaging equipment, observations on suction bucket penetration obtained via ROV), the suction pump would reverse flow, moving water into the suction bucket and increasing the pressure within the bucket, which would assist in removal from the seabed. The suction pump is expected to operate with the same

[1] Stream function theory was used to model the zone of influence based on the pump flow rate and ambient ocean current data collected from the Lease Area by Beacon Wind during site assessment activities. Modeling results indicated that the zone of influence would have a radial distance of 2.5 feet (0.8 meter) and a depth of 1 foot (0.3 meter) in the fall, resulting in a total area of 20 square feet (1.9 square meters). In the other seasons, the radial distance of the zone of influence would be reduced to 2 feet (0.6 meter), resulting in a total area of 13 square feet (1.2 square meters).

pump velocity during removal as during installation (i.e., 5.2 feet per second [1.6 meters per second]). During removal, the ROV(s) may be used to observe and gather data on the process of recovering the foundation from the seabed. Once the bucket is released from the seabed, it would be lifted vertically with a crane and placed back aboard the testing vessel. Then the reference frame would be lifted vertically with a separate winch and brought aboard the vessel. If weather conditions make lifting the bucket onboard hazardous, the bucket may be left suspended under the vessel as the vessel transits at 1 to 2 knots (2 to 4 kilometers per hour) to the next testing location. The reference frame can be brought aboard regardless of weather conditions due to its smaller size and would not be transported suspended under the vessel at any time.

At the completion of testing, no materials or debris would remain on the seabed. Photo documentation of all installed and removed equipment would be used to ensure that no equipment is left in place. A post-test photographic survey using ROVs would be conducted to confirm that the seabed has been cleared of any obstructions created by the foundation testing activities. Additionally, Beacon Wind would use sector scanning sonar for the site clearance survey. The sonar equipment under consideration would be operated at frequencies at or above 300 kilohertz.

Table 1 – Coordinates for potential test sites for foundation testing

Wind Turbine Location Name	Latitude (Center of Foundation Testing area)	Longitude (Center of Foundation Testing area)
AW42	40.97132	-70.3722
AZ40	40.92075	-70.4151
BC41	40.87099	-70.3921
BC37	40.86989	-70.4800
BD35	40.85264	-70.5235
BE33	40.83538	-70.5671
BE34	40.83567	-70.5451
BE36	40.83625	-70.5012
BE37	40.83654	-70.4792
BF30	40.81778	-70.6325
BF36	40.81957	-70.5008
BG33	40.80202	-70.5663
BG34	40.80232	-70.5443
BG35	40.80261	-70.5224
BG37	40.80318	-70.4785
BG38	40.80346	-70.4565
BH35	40.78593	-70.5220
BJ31	40.76806	-70.6094
BK30	40.75108	-70.6309
BK28	40.75045	-70.6748
BK27	40.75013	-70.6967
BM28	40.71709	-70.6739
BM29	40.71741	-70.6520
BM31	40.71803	-70.6082
BN28	40.70042	-70.6735
BK26	40.74980	-70.7186

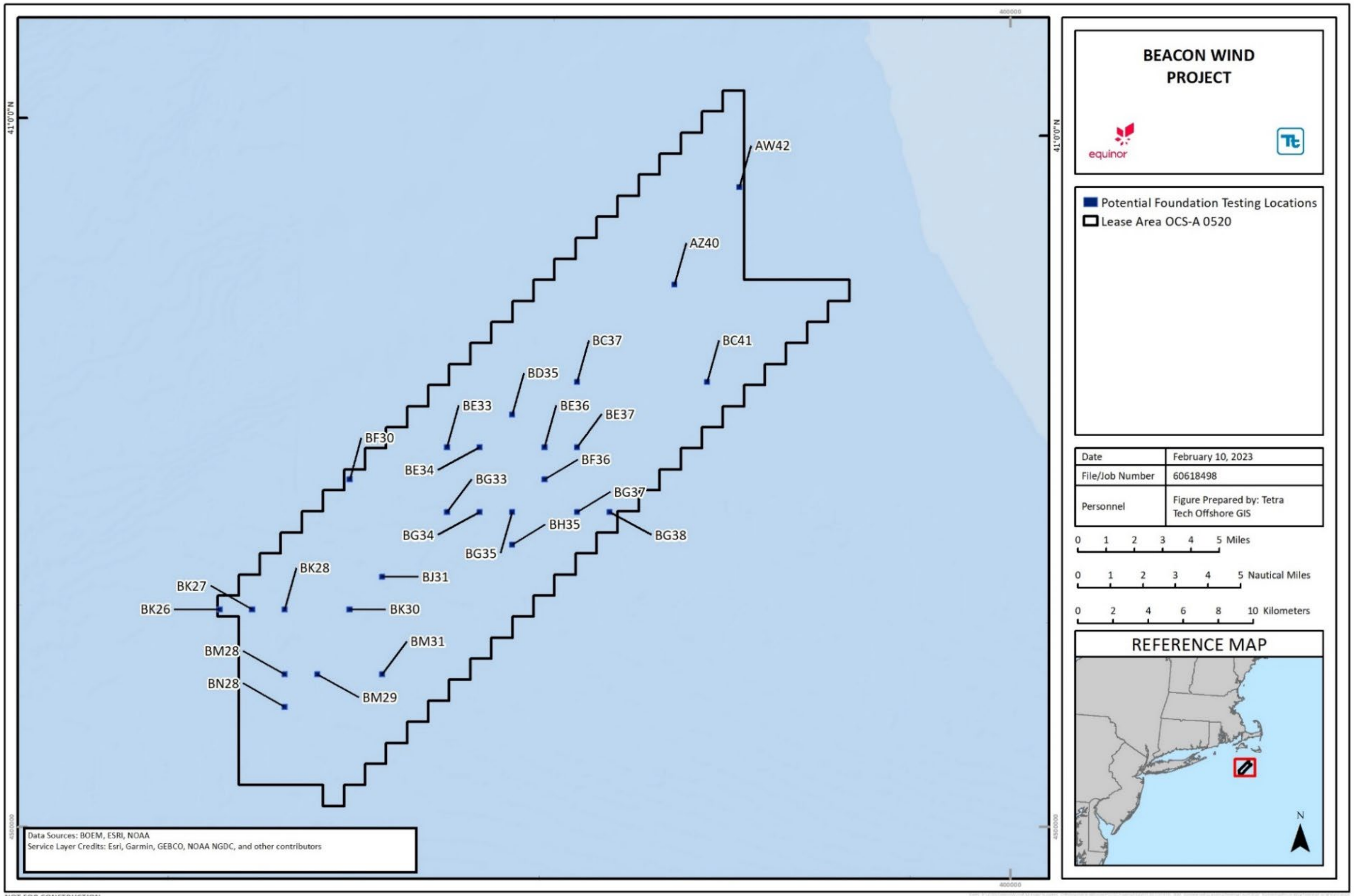

Figure 1 – Potential testing sites for foundation testing

A single vessel equipped with dynamic positioning (DP) thrusters and multiple cranes would be utilized for foundation testing. No anchoring is required with the DP system. The vessel would be approximately 515 feet (157 meters) in length with a maximum draft of approximately 28 feet (8.5 meters). The operational speed of the vessel during testing and transit, when not under speed restrictions, would be 11 to 12 knots (20 to 22 kilometers per hour). The vessel would be equipped with multiple work-class ROVs. The ROVs would be tethered to and operated from the vessel to support foundation testing, as described above, and would operate within the water column using hydraulic propellers or thrusters so as not to make contact with the seabed.

The vessel will travel from Europe, with the suction bucket, to ports in Canada and/or U.S. where the crew will mobilize. Ports currently under consideration include Halifax, Nova Scotia; New Bedford, Massachusetts; Providence, Rhode Island; and Davisville, Rhode Island. From the mobilization port(s), the vessel will make a single trip to the Lease Area to conduct the foundation testing; once testing is complete, the vessel will depart the Lease Area for ports in eastern Canada or the eastern U.S. to demobilize the crew.

Beacon Wind would conform with the applicable best management practices (BMPs) and project design criteria (PDCs) from the *Project Design Criteria and Best Management Practices for Protected Species Associated with Offshore Wind Data Collection* (BOEM 2021). Accordingly, Beacon Wind proposes to implement the following measures to avoid or minimize potential impacts of foundation testing activities on ESA-listed species:

- The vessel would utilize its DP thrusters during suction bucket installation and removal, which will avoid anchoring impacts to benthic resources in accordance with BMP 1.1 under PDC 1;
- Foundation testing would be conducted at sites without sensitive benthic habitats (e.g., hard bottom, seagrass), which will avoid impacts to these benthic resources in accordance with BMP 1.1 under PDC 1;
- Beacon Wind would conduct marine debris awareness training, as described in BMP 3.1 under PDC 3 and submit a training compliance report, as described in BMP 3.2 under PDC 3;
- Beacon Wind would recover marine trash and debris resulting from the proposed project that could cause undue harm or damage to natural resources, in accordance with BMP 3.4 under PDC 3;
- Beacon Wind would comply with measures to minimize vessel interactions with protected species, as described under PDC 5, including maintaining a vigilant watch for protected species (BMP 5.1), maintenance of a 1,640-foot (500-meter) minimum separation distance from any sighted ESA-listed species and implementation of vessel strike avoidance procedures (BMP 5.2), and the use of trained lookouts (BMPs 5.2 and 5.3, as well as BMPs 7.2, 7.4, and 7.5 under PDC 7). These measures are described in more detail in the assessment of vessel traffic effects below.
- The foundation testing vessel, regardless of length, would observe a 10-knot speed restriction in the Block Island Sound Seasonal Management Area from November 1 through April 30 and any Dynamic Management Areas or Slow Zones when in effect, in accordance with BMPs 5.4 and 5.5 under PDC 5;

- Beacon Wind would ensure that all vessel operators check for information regarding mandatory or voluntary ship strike avoidance and daily information regarding North Atlantic right whale (NARW) sightings, in accordance with BMP 5.6 under PDC 5; and
- In compliance with the Beacon Wind lease (Lease OCS-A 0520), the foundation testing vessel would operate at 10 knots or less in all U.S. waters between November 1 and July 31; and
- Beacon Wind would comply with the reporting requirements described under PDC 8.

In addition to the use of lookouts during transit proposed by Beacon Wind, as described above, BOEM would require Protected Species Observers (PSOs) or trained project personnel to monitor for listed species in the area prior to and during deployment and retrieval of the suction bucket and reference frame and work would be stopped if ESA-listed species are observed within 1,640 feet (500 meters) of the vessel.

Description of the Action Area

The action area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR §402.02). For this project, the action area includes the Lease Area (**Figure 1**) and the transit corridor between the vessel's port of origin in Europe, the mobilization/demobilization port(s), and the Lease Area. This area is expected to encompass all of the effects of the proposed project.

Habitat within the action area was described in BOEM's (2014) *Environmental Assessment for Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts*, which is incorporated here by reference. The Lease Area is 128,811 acres (521 square kilometers) in size and located in the center of the Massachusetts Wind Energy Area (WEA), approximately 20 miles (32 kilometers) south of Nantucket, Massachusetts and 60 miles (97 kilometers) east of Montauk, New York. Water depths in the Lease Area range from 118 to 223 feet (36 to 62 meters) (Beacon Wind 2024). Videographic data demonstrate that the seabed within the action area is characterized by soft-bottom habitat composed primarily of fine sediment (i.e., very fine sand and silt) (Beacon Wind 2023, 2024). No hard-bottom substrates or sensitive habitats/communities were identified at any testing sites (Beacon Wind 2024).

NMFS Listed Species and Critical Habitat in the Action Area

Five ESA-listed marine mammal species, four ESA-listed sea turtle species, and three ESA-listed fish species could potentially occur in the Massachusetts WEA (**Table 2**). Descriptions for most of these species were provided in (BOEM 2014), which is incorporated here by reference, and are updated below with new data and information that has been collected since publication of BOEM (2014); the giant manta ray (*Manta birostris*) and oceanic whitetip shark (*Carcharhinus longimanus*) were listed under the ESA since publication of BOEM (2014). Information on these species is also provided in this section.

Table 2 – ESA-listed species that could occur in the Massachusetts WEA

Species	DPS	ESA Status	Listing Date	Recovery Plan
Marine Mammals				
Blue whale *Balaenoptera musculus*	N/A	Endangered	1970 (35 FR 18319)	NMFS 2020b
Fin whale *B. physalus*	N/A	Endangered	1970 (35 FR 18319)	NMFS 2010a
North Atlantic right whale *Eubalaena glacialis*	N/A	Endangered	2008 (73 FR 12024)	NMFS 2005
Sei whale *B. borealis*	N/A	Endangered	1970 (35 FR 18319)	NMFS 2011
Sperm whale *Physeter macrocephalus*	N/A	Endangered	1970 (35 FR 18319)	NMFS 2010b
Sea Turtles				
Green sea turtle *Chelonia mydas*	North Atlantic	Threatened	2016 (81 FR 20057)	NMFS and USFWS 1991
Kemp's ridley sea turtle *Lepidochelys kempii*	N/A	Endangered	1970 (35 FR 18319)	NMFS and USFWS 2011
Leatherback sea turtle *Dermochelys coriacea*	N/A	Endangered	1970 (35 FR 8491)	NMFS and USFWS 1992
Loggerhead sea turtle *Caretta caretta*	Northwest Atlantic	Threatened	2011 (76 FR 58868)	NMFS and USFWS 2008
Fish				
Atlantic sturgeon *Acipenser oxyrhinchus oxyrhinchus*	Gulf of Maine	Threatened	2012 (77 FR 5880)	N/A
	New York Bight	Endangered	2012 (77 FR 5880)	N/A
	Chesapeake Bay	Endangered	2012 (77 FR 5880)	N/A
	Carolina	Endangered	2012 (77 FR 5914)	N/A
	South Atlantic	Endangered	2012 (77 FR 5914)	N/A
Giant manta ray *Manta birostris*	N/A	Threatened	2018 (83 FR 2916)	N/A
Oceanic whitetip shark *Carcharhinus longimanus*	N/A	Threatened	2018 (83 FR 4153)	N/A

Marine Mammals

Blue whale: As described by BOEM (2014), blue whales are occasional visitors to waters of the U.S. East Coast and have the potential to occur occasionally in the Massachusetts WEA. This species was not documented in aerial surveys of the WEA (Kraus et al. 2016; O'Brien et al. 2020, 2021, 2022, 2023; Quintana et al. 2019) or aerial survey or vessel-based PSO data from the Lease Area (Beacon Wind 2024). Blue whales were acoustically detected by hydrophones deployed in the WEA from 2011 to 2015, with the highest detections in the winter months (i.e., December through February) and a low number of detections in August, September, and November (Kraus et al. 2016). Though the species was acoustically detected by hydrophones in the WEA, the calling whales may have been located far outside the WEA, given the estimated detection range for blue whales was more than 124 miles (200 kilometers) (Kraus et al. 2016). A hydrophone deployed off Martha's Vineyard in 2021 did not detect blue whales (WHOI 2021). Given the absence of this species in aerial survey data and recent passive acoustic monitoring, it would occur rarely, if at all, in the Lease Area. If blue whales do utilize the Lease Area, it would likely be as a migration corridor based on the seasonality of acoustic detections (Kraus et al. 2013). Based on the available information, blue whales are not expected to occur in the action area during foundation testing activities. Therefore, this species is not considered further in this evaluation.

<u>Fin whale:</u> As described by BOEM (2014), fin whales may occur in the WEA throughout the year and may utilize the area for foraging during the summer. This species was sighted in aerial surveys of the WEA in most months, with the majority of sightings occurring in the spring and summer (April through August) (Kraus et al. 2016; O'Brien et al. 2020, 2021; Quintana et al. 2019). Fin whale was detected acoustically in all months (Kraus et al. 2016). During site-specific surveys of the Lease Area, fin whale was observed during aerial surveys and by vessel-based PSOs (Beacon Wind 2024). Based on the aerial survey data, PSO sightings, and passive acoustic data, fin whale is expected to be found commonly in the Lease Area and could occur year-round. Monthly density estimates in the Lease Area are provided in **Table 3**. Fin whales with calves have been sighted in the Massachusetts WEA aerial surveys (Kraus et al. 2016), indicating that life stages from calves to adults could occur in the Lease Area. Fin whales have been observed feeding during aerial surveys of the Massachusetts WEA in the spring and summer months (Kraus et al. 2016; O'Brien et al. 2023; Quintana et al. 2019), indicating that fin whales may potentially use the WEA for foraging. Based on the available information, fin whale calves, juveniles, or adults may be moving through or foraging in the action area during foundation testing activities.

<u>North Atlantic right whale:</u> As described by BOEM (2014), NARW may occur in the WEA throughout the year. This species was sighted in aerial surveys of the Massachusetts WEA in all seasons, with highest sightings in the winter months followed by the spring (Kraus et al. 2016; O'Brien et al. 2020, 2021, 2022; Quintana et al. 2019). Based on sighting data from 2012 to 2015, a NARW spring hotspot was identified that overlaps with the Lease Area (Kraus et al. 2016). In more recent years, most NARW sightings generally occurred outside the WEA (O'Brien et al. 2020, 2021, 2023). During site-specific surveys of the Lease Area, NARWs were not identified. However, this species was observed in the Lease Area by vessel-based PSOs (Beacon Wind 2024). NARWs were detected acoustically in all seasons with the greatest detections occurring in the late winter and early spring (i.e., February through April) (Kraus et al. 2016). Based on sightings and acoustic data, NARW are expected to occur commonly in the Lease Area during winter and spring and could occur less frequently in the other seasons. Monthly density estimates in the Lease Area are provided in **Table 3**. NARWs with calves have been sighted in aerial surveys of the Massachusetts WEA (O'Brien et al. 2020, 2022), indicating that life stages from calves to adults could occur in the Lease Area. Pregnant females have also been documented in these aerial surveys (O'Brien et al. 2022). NARW have been observed feeding during aerial surveys of the Massachusetts WEA (O'Brien et al. 2020, 2022; Quintana et al. 2019), though in later years of the survey feeding occurred outside the WEA. The presence of foraging NARWs in aerial surveys indicates that this species may use the Lease Area for foraging. Surface active groups of NARW have been documented in aerial surveys of the Massachusetts WEA (Kraus et al. 2016; O'Brien et al. 2022, 2023), indicating that the Lease

Area could potentially be used for mating activities. Based on the available information, NARW calves, juveniles, or adults may be moving through, foraging in, or engaging in courtship activities within the action area during foundation testing activities.

<u>Sei whale:</u> As described by BOEM (2014), sei whales are relatively uncommon in the Massachusetts WEA. In aerial surveys of the Massachusetts WEA, sei whales were sighted in the spring and summer (Kraus et al. 2016; O'Brien et al. 2020, 2022, 2023; Quintana et al. 2019). During site-specific surveys of the Lease Area, sei whales were not identified. However, this species was observed in the Lease Area by vessel-based PSOs (Beacon Wind 2024). A hydrophone deployed off Martha's Vineyard in 2021 detected sei whales from January through April and October, with the highest detections observed in March (WHOI 2021). Based on the visual and acoustic detections for sei whales, this species is expected to occur commonly in the Lease Area, predominantly in spring. Monthly density estimates in the Lease Area are provided in **Table 3**. Sei whales with calves were documented during aerial surveys of the Massachusetts WEA (Kraus et al. 2016), indicating that life stages from calves to adults have the potential to occur in the Lease Area. Sei whales have been observed feeding during the Massachusetts WEA aerial surveys (Kraus et al. 2016), indicating that the Lease Area may be utilized for foraging. Based on the available information, sei whale calves, juveniles, or adults may be moving through or foraging in the action area during foundation testing activities.

<u>Sperm whale:</u> As described by BOEM (2014), sperm whales are relatively uncommon in the Massachusetts WEA. Sperm whales were sighted infrequently during the spring, summer, and fall seasons in aerial surveys of the Massachusetts WEA (Kraus et al. 2016; O'Brien et al. 2020). In contrast to fin whales, NARWs, and sei whales, there were multiple survey years in which this species was not sighted (e.g., Quintana et al. 2019; O'Brien et al. 2021, 2022, 2023). Sperm whales were not observed during site-specific surveys in the Lease Area (Beacon Wind 2024). Based on sightings data, sperm whales may occur uncommonly in the Lease Area, with the greatest likelihood of occurrence during summer. Monthly density estimates in the Lease Area are provided in **Table 3**. Based on the available information, sperm whale juveniles or adults may infrequently transit through the action area during foundation testing activities.

Table 3 – Mean monthly density estimates for ESA-listed marine mammals in Lease Area OCS-A 0520

Species	Mean Monthly Density Estimates Animals/39 Square Miles (100 Square Kilometers)[1, 2]											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Fin whale	0.214	0.165	0.122	0.155	0.271	0.257	0.424	0.330	0.235	0.068	0.050	0.139
NARW	0.471	0.539	0.498	0.477	0.331	0.060	0.032	0.022	0.033	0.054	0.091	0.278
Sei whale	0.038	0.023	0.047	0.115	0.188	0.057	0.014	0.011	0.018	0.037	0.083	0.066
Sperm whale	0.036	0.014	0.014	0.003	0.014	0.029	0.046	0.142	0.074	0.058	0.035	0.024

Source: COP Appendix L, Table 32; Beacon Wind 2024a.
[1] Based on Lease Area OCS-A 0520 with a 6.2-mile (10-kilometer) buffer.
[2] Density estimates are from habitat-based density modeling of the entire U.S. Atlantic EEZ from Roberts et al. (2016, 2022).

Sea Turtles
<u>Green sea turtle:</u> As described by BOEM (2014), green sea turtles are not expected to occur regularly in the WEA. This species was not sighted in aerial surveys of the Massachusetts WEA (Kraus et al. 2016; O'Brien et al. 2020, 2021, 2022, 2023; Quintana et al. 2019) or the Lease

Area (Beacon Wind 2024). Monthly density estimates in the Lease Area are provided in **Table 4**. Only the juvenile life stage is expected to occur in the region (BOEM 2014). Based on the available information, juvenile green sea turtles may infrequently transit through the action area during foundation testing activities.

Kemp's ridley sea turtle: As described by BOEM (2014), Kemp's ridley sea turtles may occur in the region in the summer and early fall. This species was the least commonly observed sea turtle species in aerial surveys of the Massachusetts WEA and was only observed in the fall (Kraus et al. 2016), though this species' small size makes it difficult to detect in aerial surveys. A single Kemp's ridley sea turtle was observed during site-specific aerial surveys of the Lease Area in July (Beacon Wind 2024). Monthly density estimates in the Lease Area are provided in **Table 4**. Kemp's ridley sea turtles that occur in the Lease Area would most likely be juveniles (BOEM 2014). Based on the available information, juvenile Kemp's ridley sea turtles may transit through or forage in the action area during foundation testing activities.

Leatherback sea turtle: As described by BOEM (2014), leatherback sea turtle may occur in the WEA from late spring through the late fall. This species was the most commonly sighted sea turtle in aerial surveys of the Massachusetts WEA and was observed from the spring through the fall with the greatest number of sightings documented in the summer (Kraus et al. 2016; O'Brien et al. 2020, 2021, 2022, 2023; Quintana et al. 2019). Though leatherback sea turtles were documented in the WEA during aerial surveys, they occurred in greater numbers closer to Nantucket, north of the WEA. Nantucket Shoals has previously been identified as a hotspot for this species (BOEM 2014). This species was not observed during site-specific aerial surveys of the Lease Area (Beacon Wind 2024). Monthly density estimates in the Lease Area are provided in **Table 4**. Adults and juveniles may occur in the Lease Area (BOEM 2014). Based on the available information, juvenile and adult leatherback sea turtles may transit through or forage in the action area during foundation testing activities.

Loggerhead sea turtle: As described by BOEM (2014), loggerhead sea turtle may occur in the WEA from late spring into the fall. This species was observed from the spring through the fall in aerial surveys of the Massachusetts WEA, with the highest occurrence in the fall or summer (Kraus et al. 2016; O'Brien et al. 2020, 2021, 2022, 2023; Quintana et al. 2019). A single loggerhead sea turtle was observed during site-specific aerial surveys of the Lease Area in July (Beacon Wind 2024). Monthly density estimates in the Lease Area are provided in **Table 4**. Though both adults and juveniles could occur in the Lease Area, a majority of loggerheads in the region are juveniles (BOEM 2014). Based on the available information, juvenile and adult loggerhead sea turtles may transit through the action area during foundation testing activities.

Table 4 – Mean monthly density estimates for ESA-listed sea turtles in Lease Area OCS-A 0520

Species	Mean Monthly Density Estimates Animals/39 Square Miles (100 Square Kilometers)[1, 2]											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Green	0.000	0.000	0.000	0.000	0.000	0.021	0.095	0.091	0.088	0.015	0.002	0.000
Kemp's ridley	0.000	0.000	0.000	0.000	0.000	0.002	0.005	0.004	0.004	0.003	<0.001	0.000
Leatherback	<0.001	<0.001	<0.001	<0.001	0.002	0.042	0.104	0.170	0.244	0.146	0.025	0.002
Loggerhead	0.002	<0.001	<0.001	0.001	0.003	0.011	0.020	0.021	0.026	0.026	0.012	0.003

Source: COP Appendix L, Table 34; Beacon Wind 2024.
[1] Based on Lease Area OCS-A 0520 with a 6.2-mile (10-kilometer) buffer.
[2] Density estimates are obtained from DiMatteo et al. (2023).

Fish

Atlantic sturgeon: As described by BOEM (2014), Atlantic sturgeon have been caught in offshore trawl and gillnet fisheries, but this species is expected to largely remain in waters with depths less than 66 feet (20 meters). Sub-adult and adult Atlantic sturgeon occur in the offshore marine environment from the summer through the winter (Stein et al. 2004), indicating that these life stages could be present in the Lease Area during these seasons. In the marine environment, this species forages in soft-bottom habitats of the continental shelf (Dunton et al. 2015). Any of the five distinct population segments (DPSs) of Atlantic sturgeon listed under the ESA could occur in the WEA, though the majority are expected to belong to the New York Bight DPS based on genetic analysis of Atlantic sturgeon collected through the Northeast Fishery Observer Program (BOEM 2014). Based on the available information, sub-adult or adult Atlantic sturgeon from any listed DPS may infrequently migrate through or opportunistically forage in the action area during foundation testing activities if the activities occur outside of the spring months.

Giant manta ray: Sightings of giant manta rays in the Mid-Atlantic and in New England are rare, though individuals have been documented as far north as New Jersey and Block Island (Gudger 1922; Miller and Klimovish 2017). Sightings of unidentified rays were occasionally documented in early aerial surveys of the Massachusetts WEA (Kraus et al. 2016), but as these sightings were not identified to species they cannot confirm the occurrence of giant manta ray in the WEA. Giant manta ray was not documented in site-specific aerial surveys of the Lease Area (Beacon Wind 2024). Given the rarity of this species in the region, giant manta ray is not expected to occur in the action area during foundation testing activities. Therefore, this species is not considered further in this evaluation.

Oceanic whitetip shark: Oceanic whitetip shark is generally found in tropical and subtropical oceans worldwide, inhabiting deep, offshore waters (NMFS 2022). In the western Atlantic, oceanic whitetips occur as far north as Maine but are generally found at latitudes below 30° N (NMFS 2016). This species exhibits a strong preference for water temperatures at or above 68°F (20°C) (NMFS 2016). Oceanic whitetip shark has not been documented in aerial surveys of the Massachusetts WEA (Kraus et al. 2016; O'Brien et al. 2020, 2021, 2022, 2023; Quintana et al. 2019), though some sharks could not be identified to species. A single oceanic whitetip shark was documented in August during site-specific aerial surveys of the Lease Area (Beacon Wind 2024). Based on its habitat preference, oceanic whitetip shark is not expected to occur in the action area during foundation testing activities. Therefore, this species is not considered further in this evaluation.

North Atlantic Right Whale Critical Habitat
The foundation testing vessel would likely transit through the southern edge of NARW critical habitat Unit 1, the feeding areas in Cape Cod Bay, Stellwagen Bank, and the Great South Channel, when traveling between its origin/destination port in Europe and the mobilization/demobilization port(s) for the proposed project. The Lease Area is approximately 38 miles (61 kilometers) south of NARW critical habitat Unit 1.

The physical and biological features of NARW foraging critical habitat (i.e., Unit 1) identified as essential to conservation of the species include:

- The physical oceanographic conditions and structures of the Gulf of Maine and Georges Bank region that combine to distribute and aggregate *Calanus finmarchicus* for right whale foraging, namely prevailing currents and circulation patterns, bathymetric features (basins, banks, and channels), oceanic fronts, density gradients, and temperature regimes;
- Low flow velocities in Jordan, Wilkinson, and Georges Basins that allow diapausing *C. finmarchicus* to aggregate passively below the convective layer so that the copepods are retained in the basins;
- Late stage *C. finmarchicus* in dense aggregations in the Gulf of Maine and Georges Bank region; and
- Diapausing *C. finmarchicus* in aggregations in the Gulf of Maine and Georges Bank region.

Effects Determination
Benthic Habitat Disturbance
Installation and removal of the suction bucket and the placement and removal of the reference frame would result in temporary disturbance of benthic habitat in the action area. As described above, the suction bucket would occupy approximately 1,195 square feet (111 square meters) of seabed, and the reference frame would occupy approximately 11 square feet (1 square meter), resulting in a total of approximately 1,206 square feet (114 square meters) of seabed disturbance at each test site. Additionally, approximately 15.8 square feet (1.5 square meters) would be temporarily disturbed by acoustic monitoring equipment at each site. Across 26 testing sites, up to 0.7 acres (2,873 square meters) would be disturbed during foundation testing, including the suction bucket, reference frame, and acoustic monitoring equipment footprints. It is conservatively assumed that all benthic organisms within the footprint of the suction bucket and reference frame, which benthic foragers may feed upon, would suffer mortality. This benthic organism mortality would be localized, and recolonization and recovery of benthic species is expected to occur within a few months to one year (Wilbur and Clarke 2007).

<u>Marine Mammals</u>
Since none of the ESA-listed marine mammals that may occur in the action area are benthic foragers, benthic habitat disturbance would have *no effect* on fin whale, NARW, sei whale, or sperm whale.

<u>Sea Turtles</u>
As green sea turtles, leatherback sea turtles, and loggerhead sea turtles do not forage in the soft-bottom habitats present in the action area, benthic habitat disturbance would have *no effect* on

these species. Juvenile Kemp's ridley sea turtles that may occur in the Lease Area do forage in this type of habitat. However, the anticipated benthic prey mortality would be temporary and would be localized to a very small portion of the action area. Given the temporary, short-term nature of the prey reduction and the availability of equivalent foraging habitat in the area, any effect on the foraging success of Kemp's ridley sea turtles due to benthic habitat disturbance as a result of foundation testing are extremely unlikely to occur would therefore be *discountable*.

When this project is completed, it would not result in permanent loss or disturbance of soft bottom habitat, and thus, there would be no prey mortality or reduction in foraging habitat in the future. We have also considered the likelihood that an increase benthic habitat disturbance related to the activities associated with the proposed project would generally reduce prey availability or foraging habitat in the action area, in addition to baseline conditions. As described above, the foundation testing would cause localized prey mortality in the footprint of the suction bucket and reference frame. Given the relatively small affected area in addition to existing habitat disturbance associated with ongoing activities in the action area, reductions in foraging success of Kemp's ridley sea turtle are extremely unlikely to occur. Therefore, effects of habitat disturbance would be *discountable*.

<u>Fish</u>
Atlantic sturgeon are benthic foragers that forage in soft-bottom habitats. Therefore, this species may experience a reduction in prey availability and foraging opportunities due to benthic habitat disturbance as a result of foundation testing. However, ample foraging habitat is available to fish in the surrounding area and the prey mortality from suction bucket testing would be temporary and localized to a very small portion of the action area. Given the temporary and localized nature of potential prey mortality that may occur and the large area of soft-bottom habitat that would remain available for foraging animals, potential effects of prey mortality on the foraging success of Atlantic sturgeon are extremely unlikely to occur and would therefore be *discountable*.

When this project is completed, it would not result in permanent loss or disturbance of soft bottom habitat, and thus, there would be no prey mortality or reduction in foraging habitat in the future. We have also considered the likelihood that an increase benthic habitat disturbance related to the activities associated with the proposed project would generally reduce prey availability or foraging habitat in the action area, in addition to baseline conditions. As described above, the foundation testing would cause localized prey mortality in the footprint of the suction bucket and reference frame. Given the relatively small affected area in addition to existing habitat disturbance associated with ongoing activities in the action area, reductions in foraging success of Atlantic sturgeon are extremely unlikely to occur. Therefore, effects of habitat disturbance would be *discountable*.

Turbidity
The installation and removal of the suction bucket and the placement and removal of the reference frame would result in temporary increases in suspended sediment concentrations at the testing sites. As suction bucket foundations require less benthic disturbance compared to other offshore wind foundation types (Horwath et al. 2021), suspended sediment concentrations associated with installation and removal of the suction bucket and reference frame would be expected to be similar to or lesser than suspended sediment concentrations associated site

preparation activities for other foundation types (e.g., dredging for sand bedform clearing). Modeling results of cutterhead dredging indicate that suspended sediment concentrations above background levels would be present throughout the bottom 6 feet (1.8 meters) of the water column for a distance of approximately 1,000 feet (305 meters) (NMFS 2020c citing USACE 1983). Elevated suspended sediment levels are expected to be present only within a 984 to 1,640 feet (300 to 500 meters) radius of the cutterhead dredge (NMFS 2020c citing Hayes et al. 2000; NMFS 2020c citing LaSalle 1990; NMFS 2020c citing USACE 1983). Suspended sediment concentrations associated with cutterhead dredge sediment plumes typically range from 11.5 to 282.0 milligrams per liter with the highest levels (550.0 milligrams per liter) detected adjacent to the cutterhead dredge and concentrations decreasing with greater distance from the dredge (NMFS 2020c citing Nightingale and Simenstad 2001; NMFS 2020c citing USACE 2005, 2010, 2015). Based on this information, the localized sediment plume generated by the proposed foundation testing may extend 984 to 1,640 feet (300 to 500 meters) along the seabed with suspended sediment concentrations of 282 milligrams per liter or less, with higher concentrations possible immediately adjacent to suction bucket upon removal. The plume is expected to dissipate rapidly.

Marine Mammals

As described in Johnson (2018), NMFS has determined that elevated turbidity could result in effects on ESA-listed marine mammal species under specific circumstances, such as high turbidity levels over long periods during dredging operations; however, the turbidity levels associated with the proposed project would be small. In general, marine mammals are not subject to the types of impacts that injure fish (e.g., gill clogging, smothering of eggs and larvae), so physiological effects are unlikely. Behavioral impacts, including avoidance or changes in behavior, increased stress, and temporary loss of foraging opportunity could occur but only at high concentrations of suspended sediment (Johnson 2018). Turbidity associated with the proposed project would be temporary and localized to within 6 feet (1.8) meters of the seabed due to installation and removal of the suction bucket. Placement and removal of the suction bucket and reference frame are not expected to result in behavioral impacts on ESA-listed marine mammals, which would not be expected to occur in such proximity to the seabed in the Lease Area. Therefore, the effects of turbidity associated with foundation testing on fin whale, NARW, sei whale, or sperm whale are extremely unlikely to occur and are therefore *discountable*.

When this project is completed, it will not result in a permanent increase in turbidity in the action area, and thus, there is no potential for behavioral impacts in the future. We have also considered the likelihood that an increase in turbidity related to the activities associated with the proposed project would generally increase risk of behavioral disruption of marine mammals in the action area, in addition to baseline conditions. The placement and removal of the suction bucket and reference frame would cause a localized, short-term increase in turbidity. Given the short duration and the localized area of increased suspended sediment concentrations above existing levels in the action area, behavioral impacts are extremely unlikely to occur. Therefore, effects of turbidity would be *discountable*.

Sea Turtles

There are no data to indicate that suspended sediment has physiological effects on sea turtles. However, elevated suspended sediment may cause alterations to normal movements or behavioral disruption as sea turtles would be expected to avoid the area of elevated suspended sediment. Given the localized nature of the sediment plume and the rapid dissipation of the plume, any effects of behavioral reactions in green, Kemp's ridley, leatherback, or loggerhead sea turtles due to turbidity associated with foundation testing would be too small to be meaningfully measured, detected, or evaluated and would therefore be *insignificant*.

Elevated suspended sediment concentrations can affect benthic communities, which could impact Kemp's ridley sea turtle as this species forages in soft-bottom habitats. Suspended sediment concentrations high enough to result in adverse impacts to the benthic community (i.e., above 390 milligrams per liter [USEPA 1986]) are not expected throughout most of the plume. Based on plumes generated by hydraulic dredging, it may be possible that suspended sediment concentrations would exceed this threshold immediately adjacent to the suction bucket upon removal. If this threshold were exceeded, prey availability or foraging opportunities may be temporarily reduced in the area immediately outside the footprint of the suction bucket. Given the temporary, short-term nature of the prey reduction, the small scale of the reduction, and the large area of soft-bottom habitat that would remain available for foraging, any effect of a reduction in prey availability or foraging opportunities for Kemp's ridley sea turtle due to increased turbidity as a result of foundation testing would be too small to be meaningfully detected, measured, or evaluated and would therefore be *insignificant*.

When this project is completed, it will not result in a permanent increase in turbidity in the action area, and thus, there is no potential for behavioral reactions or prey impacts in the future. We have also considered the likelihood that an increase in turbidity related to the activities associated with the proposed project would generally increase risk of behavioral disruption of sea turtles or mortality of benthic prey in the action area, in addition to baseline conditions. The placement and removal of the suction bucket and reference frame would cause a localized, short-term increase in turbidity. Given the short duration and the localized area of increased suspended sediment concentrations above existing levels in the action area, effects of behavioral impacts or reductions in foraging success due to prey impacts would be too small to be meaningfully detected, measured, or evaluated. Therefore, effects of turbidity would be *insignificant*.

<u>Fish</u>

Turbidity levels shown to have adverse effects on fish are typically above 1,000 milligrams per liter (see Burton 1993 and Wilber and Clarke 2001). Potential physiological effects of suspended sediment on fish include gill clogging and increased stress (NMFS 2017). Increased turbidity can also result in behavioral effects in fish, such as foraging interference or inhibition of movement (NMFS 2017). However, increased turbidity is not expected to impact the ability of Atlantic sturgeon to forage as they are not visual foragers. Sturgeon rely on their barbels to detect prey and are known to forage during nighttime hours (NMFS 2017). Suspended sediment concentrations below those associated with physiological impacts (i.e., above 1,000 milligrams per liter) are not expected to inhibit sturgeon movement (NMFS 2017). As the suspended sediment concentrations associated with foundation testing are not expected to exceed 1,000 milligrams per liter, turbidity effects on Atlantic sturgeon are extremely unlikely to occur and would therefore be *discountable*.

As noted above, suspended sediment concentrations immediately adjacent to the suction bucket upon removal could potentially result in adverse impacts to the benthic community. However, such a reduction, if it were to occur, would be temporary, short-term, and small scale, and a large area of soft-bottom habitat would remain available for Atlantic sturgeon foraging. Therefore, any effect of a reduction in prey availability or foraging opportunities for Atlantic sturgeon due to increased turbidity as a result of foundation testing would be too small to be meaningfully detected, measured, or evaluated and would therefore be *insignificant*.

When this project is completed, it will not result in a permanent increase in turbidity in the action area, and thus, there is no potential for prey impacts in the future. We have also considered the likelihood that an increase in turbidity related to the activities associated with the proposed project would generally increase risk of benthic prey mortality in the action area, in addition to baseline conditions. The placement and removal of the suction bucket and reference frame would cause a localized, short-term increase in turbidity. Given the short duration and the localized area of increased suspended sediment concentrations above existing levels in the action area, effects of reductions in foraging success due to prey impacts would be too small to be meaningfully detected, measured, or evaluated. Therefore, effects of turbidity would be *insignificant*.

Entrainment and Impingement
Operation of the suction pump would pull ambient water through the pump, potentially resulting in entrainment or impingement of marine organisms. As described above, up to 1,775 cubic yards (1,357 cubic meters) of water may be pumped out of the suction bucket during each installation. An equivalent amount of water may be pumped back into the suction bucket during each removal event. During 35 tests, up to 25.1 million gallons (94,990 cubic meters) of water would be pumped through the suction pump out of and into the suction bucket. Entrainment of ichthyoplankton during foundation testing was estimated based on this total volume and ichthyoplankton densities collected during the Ecosystem Monitoring (EcoMon) survey program between 1977 and 2019 (**Table 5**). The number of larval fish estimated to be entrained per test would be 9,289 fish across all species (**Table 6**), based on average August[2] plankton densities measured during the EcoMon survey program. This level of entrainment for a single test represents a fraction of the eggs produced by a single female in many fish species. Total entrainment estimated for 35 foundation installation tests is provided in **Table 7**. Based on these estimates, entrainment during suction pump operation is not expected to result in measurable impacts on plankton or fish populations in the action area.

<u>Marine Mammals</u>
Juvenile and adult fin whales, NARWs, and sei whales consume plankton that could potentially be affected by entrainment during foundation testing. Though sperm whales forage in deep-water habitats, larval forms of their prey species could potentially be entrained during foundation testing. Entrainment of plankton and larvae from operation of the suction pump would be small compared to the natural mortality and the surrounding area in which whales typically feed. Therefore, entrainment of prey is extremely unlikely to reduce foraging success of fin whales, NARWs, sei whales, and sperm whales.

[2] Ichthyoplankton densities were highest in the month of August and therefore resulted in the highest entrainment estimates.

ESA-listed whales are too large to be vulnerable to impingement on the suction pump. Therefore, impingement associated with foundation testing would have *no effect* on fin whale, NARW, sei whale, or sperm whale.

When this project is completed, it will not result in ongoing entrainment in the action area, and thus, there would be no entrainment of prey in the future. We have also considered the likelihood that entrainment related to the activities associated with the proposed project would generally reduce foraging success in the action area, in addition to baseline conditions. The installation and removal of the suction bucket during foundation testing would result in entrainment of a relatively small volume of water, and the planktonic animals within it, compared to the surrounding area. Given the relatively small level of potential prey mortality compared to existing levels in the action area, reductions in foraging success are extremely unlikely to occur. Therefore, effects of entrainment would be *discountable*.

<u>Sea Turtles</u>
Given the maximum pump opening during withdrawals from the water column (i.e., 7 inches [18 centimeters] in diameter) and the length of Kemp's ridley sea turtles (i.e., 24 inches [61 centimeters]) (NMFS 2023b), which are the smallest sea turtle species in the action area, sea turtles would not be vulnerable to entrainment through the pump. Juvenile Kemp's ridley sea turtles and juvenile and adult leatherback sea turtles may forage in the soft bottom and pelagic habitats in the Lease Area, respectively, and could therefore be affected by entrainment of planktonic larvae of their prey species. Though hard bottom foraging habitats for loggerhead sea turtles are not expected to occur in the Lease Area, planktonic larval stages of their prey could also potentially be affected by entrainment. However, entrainment of plankton from operation of the suction pump would be small compared to the surrounding area. Therefore, entrainment of prey is extremely unlikely to reduce foraging success of Kemp's ridley, leatherback, or loggerhead sea turtles. Therefore, the effects of entrainment on these species would be *discountable.* As green sea turtles forage on vegetation, entrainment associated with foundation testing would have *no effect* on this species.

As noted above, the pump velocity for the suction pump is estimated at 5.2 feet per second (1.6 meters per second). Sea turtles are capable of cruising (i.e., sustained swimming) at speeds of 3.3 to 4.4 feet per second (1 to 1.3 meters per second), and juveniles are known to forage in areas with currents of up to 3.4 feet per second (1 meter per second) (NMFS 2023a). However, sea turtles may be capable of burst speeds of up to 6.6 feet per second (2 meters per second) for a few seconds (Prange 1976), indicating that sea turtles would be able to escape the pump. Additionally, as described above, the hydraulic zone of influence of the pump would be 20 square feet or less. A sea turtle is unlikely to occur within the radius (up to 2.5 feet [0.8 meter]) of the hydraulic zone of influence while the suction pump is in operation. Therefore, effects of impingement on the suction pump on green, Kemp's ridley, leatherback, and loggerhead sea turtles are extremely unlikely to occur and would be *discountable*.

Table 5 – Mean monthly larval density estimates in Lease Area OCS-A 0520[1] for abundant fish taxa collected in the EcoMon survey program from 1977 to 2019

Species	Mean Monthly Density Estimates Larvae/3,531 Cubic Feet (100 Cubic Meters)											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
American plaice	0	0	0.2	0	0.4	0.5	0	0	0	0	0	0
Atlantic cod	2	1.5	2.3	2	0.2	0	0	0	0	0	0.6	3.8
Atlantic croaker	0	0	0	0	0.3	0	0	0	0	<0.1	<0.1	0
Atlantic herring	13.3	4.7	3.6	0	0	0	0	0	0	0.1	260.2	202.7
Atlantic mackerel	0	0	0	0	0.6	1.2	0.3	0	0	0	0	0
Atlantic menhaden	0	0	0	0	0	0	0	0	0	<0.1	9.2	0
Bluefish	0	0	0	0	0	0.1	0	0.7	0	0	0	0
Bristlemouths	0	0	0	0	0	0	0	0	0	0	0	0
Butterfish	0	0	0	0	0	0	1.1	17.2	1.2	0.1	<0.1	0
Cunner	0	0	0	0	0	0	0.7	0.5	0	0	0	0
Fourbeard rockling	0	0	0	0	0.2	2.8	1.4	0	0	0.2	<0.1	0.2
Fourspot flounder	0	0	0	0	0	0	1.4	34.6	4.8	1.1	0	0.1
Frigate tunas	0	0	0	0	0	0	0	4.7	0	0	0	0
Grubby	0	0	<0.1	0	0	0	0	0	0	0	0	0
Gulf Stream flounder	0	0	0	0	0	0	0.3	145.8	190.2	4.4	0.1	0
Haddock	0	<0.1	0.4	0	0.9	0.8	0	0	0	0	0	0
Hakes	0	0	0	0	0	0.3	14.4	114	80.4	25.4	3.2	0
Lanternfishes	0	0	0	0	0	0	0	0	0	0	0	0
Large-tooth flounder	0	0	0	0	0	0	0	0	2.2	0.3	<0.1	0
Lefteye flounders	0	0	0	0	0	0	0	0	<0.1	0.2	0	0
Longhorn sculpin	0	0.4	1.1	0.2	0	0	0	0	0	0	0	0
Madeira lantern fish	0	0	0	0	0	0	0	0	0	0.1	0	0
Monkfish	0	0	0	0	0	0.1	0	0.1	<0.1	0	0	0
Offshore hake	0	0	0	0	0	0	0	0	0	0.4	0	0
Pollock	<0.1	0.7	1.2	0	0	0	0	0	0	0	0	0
Rock gunnel	0	0.1	<0.1	0	0	0	0	0	0	0	0	0
Rockfishes	0	0	0	0	0	0	0	0	0	0	0	0
Sand lances	24.7	236.9	90.1	29.6	0.1	0.1	0	0	0	0	0	0
Sea robins	0	0	<0.1	0	0	0	0	0.8	<0.1	0	0	0
Silver hake	<0.1	0	0	0	0	0.3	5.3	21.2	4.5	16.8	3.7	1.1

Species	Mean Monthly Density Estimates Larvae/3,531 Cubic Feet (100 Cubic Meters)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Summer flounder	0	<0.1	<0.1	0	0	0	0	0	26.2	12.5	11.7	1.3
Windowpane	0	0	0	0	0.8	2.6	0	1.9	9.5	1.8	1.3	0
Winter flounder	0	<0.1	1.6	0	9.2	2.5	0	0	0	0	0	0
Witch flounder	0	0	0	0	0.9	0.4	0.4	0.1	0	0	0	0
Wolffishes	0	0	0	0	0	0	0	0	0	0	0	0
Yellowtail flounder	0	0	<0.1	0	3.1	25.9	1.1	0.1	0	0	0	0
Total	**40.1**	**244.6**	**100.8**	**31.7**	**16.7**	**37.6**	**26.3**	**342**	**319.1**	**63.5**	**290.1**	**209.2**

Source: NCEI 2023.

[1] Based on survey stations located within a 10-nautical mile (18.5-kilometer) radius of the center point of the Lease Area.

Table 6 – Estimates of larval entrainment for each suction bucket test by month

Species	Estimated Entrainment (Number of Larvae)[1]											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
American plaice	0	0	5	0	11	13	0	0	0	0	0	0
Atlantic cod	56	41	64	54	7	0	0	0	0	0	16	103
Atlantic croaker	0	0	0	0	8	0	0	0	0	3	2	0
Atlantic herring	360	128	98	0	0	0	0	0	0	4	7,062	5,503
Atlantic mackerel	0	0	0	0	18	34	10	0	0	0	0	0
Atlantic menhaden	0	0	0	0	0	0	0	0	0	2	250	0
Bluefish	0	0	0	0	0	4	0	20	0	0	0	0
Bristlemouths	0	0	0	0	0	0	0	0	0	0	0	0
Butterfish	0	0	0	0	0	0	29	467	32	5	2	0
Cunner	0	0	0	0	0	0	19	15	0	0	0	0
Fourbeard rockling	0	0	0	0	6	75	39	0	0	6	2	6
Fourspot flounder	0	0	0	0	0	0	39	941	130	31	0	4
Frigate tunas	0	0	0	0	0	0	0	129	0	0	0	0
Grubby	0	0	2	0	0	0	0	0	0	0	0	0
Gulf Stream flounder	0	0	0	0	0	0	9	3,957	5,163	119	3	0
Haddock	0	2	11	0	25	23	0	0	0	0	0	0
Hakes	0	0	0	0	0	8	390	3,096	2,184	690	88	0
Lanternfishes	0	0	0	0	0	0	0	0	0	0	0	0
Large-tooth flounder	0	0	0	0	0	0	0	0	60	7	1	0

Species	Estimated Entrainment (Number of Larvae)[1]											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lefteye flounders	0	0	0	0	0	0	0	0	2	5	0	0
Longhorn sculpin	0	12	29	5	0	0	0	0	0	0	0	0
Madeira lantern fish	0	0	0	0	0	0	0	0	0	4	0	0
Monkfish	0	0	0	0	0	4	0	4	2	0	0	0
Offshore hake	0	0	0	0	0	0	0	0	0	11	0	0
Pollock	2	19	32	0	0	0	0	0	0	0	0	0
Rock gunnel	0	4	2	0	0	0	0	0	0	0	0	0
Rockfishes	0	0	0	0	0	0	0	0	0	0	0	0
Sand lances	670	6,430	2,447	804	3	4	0	0	0	0	0	0
Sea robins	0	0	3	0	0	0	0	23	2	0	0	0
Silver hake	3	0	0	0	0	8	144	576	122	456	100	30
Summer flounder	0	3	2	0	0	0	0	0	711	339	318	36
Windowpane	0	0	0	0	23	72	0	53	259	50	35	0
Winter flounder	0	2	44	0	249	68	0	0	0	0	0	0
Witch flounder	0	0	0	0	25	12	10	4	0	0	0	0
Wolffishes	0	0	0	0	0	0	0	0	0	0	0	0
Yellowtail flounder	0	0	2	0	84	704	29	4	0	0	0	0
Total	**1,091**	**6,641**	**2,741**	**863**	**459**	**1,029**	**718**	**9,289**	**8,667**	**1,732**	**7,879**	**5,682**

[1] Based on larval densities provided in **Table 5** and a maximum volume of displaced seawater of 716,963 gallons (2,714 cubic meters).

Table 7 – Estimates of total larval entrainment for suction bucket testing by month

Species	Estimated Entrainment (Number of Larvae)[1]											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
American plaice	0	0	175	0	385	455	0	0	0	0	0	0
Atlantic cod	1,960	1,435	2,240	1,890	245	0	0	0	0	0	560	3,605
Atlantic croaker	0	0	0	0	280	0	0	0	0	105	70	0
Atlantic herring	12,600	4,480	3,430	0	0	0	0	0	0	140	247,170	192,605
Atlantic mackerel	0	0	0	0	630	1,190	350	0	0	0	0	0
Atlantic menhaden	0	0	0	0	0	0	0	0	0	70	8,750	0
Bluefish	0	0	0	0	0	140	0	700	0	0	0	0
Bristlemouths	0	0	0	0	0	0	0	0	0	0	0	0
Butterfish	0	0	0	0	0	0	1,015	16,345	1,120	175	70	0
Cunner	0	0	0	0	0	0	665	525	0	0	0	0

Species	Estimated Entrainment (Number of Larvae)[1]											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fourbeard rockling	0	0	0	0	210	2,625	1,365	0	0	210	70	210
Fourspot flounder	0	0	0	0	0	0	1,365	32,935	4,550	1,085	0	140
Frigate tunas	0	0	0	0	0	0	0	4,515	0	0	0	0
Grubby	0	0	70	0	0	0	0	0	0	0	0	0
Gulf Stream flounder	0	0	0	0	0	0	315	138,495	180,705	4,165	105	0
Haddock	0	70	385	0	875	805	0	0	0	0	0	0
Hakes	0	0	0	0	0	280	13,650	108,360	76,440	24,150	3,080	0
Lanternfishes	0	0	0	0	0	0	0	0	0	0	0	0
Large-tooth flounder	0	0	0	0	0	0	0	0	2,100	245	35	0
Lefteye flounders	0	0	0	0	0	0	0	0	70	175	0	0
Longhorn sculpin	0	420	1,015	175	0	0	0	0	0	0	0	0
Madeira lantern fish	0	0	0	0	0	0	0	0	0	140	0	0
Monkfish	0	0	0	0	0	140	0	140	70	0	0	0
Offshore hake	0	0	0	0	0	0	0	0	0	385	0	0
Pollock	70	665	1,120	0	0	0	0	0	0	0	0	0
Rock gunnel	0	140	70	0	0	0	0	0	0	0	0	0
Rockfishes	0	0	0	0	0	0	0	0	0	0	0	0
Sand lances	23,450	225,050	85,645	28,140	105	140	0	0	0	0	0	0
Sea robins	0	0	105	0	0	0	0	805	70	0	0	0
Silver hake	105	0	0	0	0	280	5,040	20,160	4,270	15,960	3,500	1,050
Summer flounder	0	105	70	0	0	0	0	0	24,885	11,865	11,130	1,260
Windowpane	0	0	0	0	805	2,520	0	1,855	9,065	1,750	1,225	0
Winter flounder	0	70	1,540	0	8,715	2,380	0	0	0	0	0	0
Witch flounder	0	0	0	0	875	420	350	140	0	0	0	0
Wolffishes	0	0	0	0	0	0	0	0	0	0	0	0
Yellowtail flounder	0	0	70	0	2,940	24,640	1,015	140	0	0	0	0
Total	**38,185**	**232,435**	**95,935**	**30,205**	**16,065**	**36,015**	**25,130**	**325,115**	**303,345**	**60,620**	**275,765**	**198,870**

[1] Based on entrainment estimates per test provided in **Table 6** and a maximum of 35 tests conducted during foundation testing (i.e., a maximum volume of 25.1 million gallons [94,900 cubic meters]).

When this project is completed, it will not result in ongoing entrainment in the action area, and thus, there would be no entrainment of prey or risk of impingement in the future. We have also considered the likelihood that entrainment related to the activities associated with the proposed project would generally reduce foraging success in the action area, in addition to baseline conditions. The installation and removal of the suction bucket during foundation testing would result in entrainment of a relatively small volume of water, and the planktonic animals within it, compared to the surrounding area. Given the relatively small level of potential prey mortality compared to existing levels in the action area, reductions in foraging success are extremely unlikely to occur. Therefore, effects of entrainment would be *discountable*.

<u>Fish</u>

Given the maximum pump opening during withdrawals from the water column (i.e., 7 inches [18 centimeters] in diameter) and that Atlantic sturgeon that may be found in the Lease Area are expected to exceed 30 inches (76 centimeters) in length (i.e., migrating subadults or older [ASSRT 2007]), this species would not be vulnerable to entrainment through the pump. Sub-adult and adult Atlantic sturgeon may forage in the Lease Area and may therefore be affected by entrainment of prey species (e.g., sand lance larvae, planktonic polychaete larvae). However, as entrainment levels are not expected to measurably reduce prey populations in the action area, the effects of any reduction in prey availability on sub-adult and adult Atlantic sturgeon would be too small to be meaningfully measured, detected, or evaluated and would therefore be *insignificant*.

As noted above, the pump velocity for the suction pump is estimated at 5.2 feet per second (1.6 meters per second). Studies of swimming performance in juvenile and sub-adult Atlantic sturgeon, white sturgeon (*Acipenser transmontanus*), and lake sturgeon (*A. fulvescens*) demonstrated that sturgeon at these life stages are capable of sustained swimming at speeds of approximately 1.5 feet per second (0.5 meter per second) and burst speeds of approximately 2.1 feet per second (0.7 meter per second) (Clarke 2011). A study of sub-adult and adult green sturgeon (*A. medirostris*) demonstrated that older sturgeon may be capable of burst speeds up to 7 feet per second (2.1 meters per second) (Kelly and Klimley 2012). Based on anticipated swimming capabilities of sub-adult and adult sturgeon, any Atlantic sturgeon occurring in the Lease Area would be able to escape the pump. Given the demersal life style of sturgeon and the anticipated location of the pump (i.e., 19 feet [6 meters] above the seabed and the estimated size of the pump's zone of influence (i.e, 20 square feet [1.8 square meters]), it is unlikely that Atlantic sturgeon would encounter the area of elevated velocity around the pump. Therefore, effects of impingement on the suction pump on Atlantic sturgeon are extremely unlikely to occur and would be *discountable*.

When this project is completed, it will not result in ongoing entrainment in the action area, and thus, there would be no entrainment of prey or risk of impingement in the future. We have also considered the likelihood that entrainment related to the activities associated with the proposed project would generally reduce foraging success in the action area, in addition to baseline conditions. The installation and removal of the suction bucket during foundation testing would result in entrainment of a relatively small volume of water, and the planktonic animals within it, compared to the surrounding area. Given the relatively small level of potential prey mortality

compared to existing levels in the action area, reductions in foraging success are extremely unlikely to occur. Therefore, effects of entrainment would be *discountable*.

Underwater Noise

The foundation testing vessel, the ROVs, the suction pump, and the imaging equipment inside the suction bucket would produce noise during foundation testing activities. Sector scanning sonar, which is currently being evaluated for potential use during the site clearance survey would also produce noise. Vessels generate low frequency, non-impulsive noise that could affect aquatic species. Source levels for transiting large vessels range from 177 to 188 dB re 1 μPa at 3 feet (1 meter) with most of the energy below 1 kilohertz and peaks in the 20–100 hertz range (McKenna et al. 2017). Jimenez-Arranz et al. (2019) measured dynamic positioning noise generated by a Mobile Offshore Drilling Unit, and, based on these measurements, estimated source levels produced by dynamic positioning would peak at approximately 188 dB re 1 μPa in the 31.5 Hz one-third octave band. Warner and McCrodan (2011) measured vessel self-noise during dynamic positioning of a geophysical and geotechnical survey vessel at less than 145 dB re 1 μPa approximately 361 feet (110 meters) from the vessel and observed that frequencies generated by the dynamic positioning thrusters varied between 110 and 140 Hz; based on measured root mean square sound levels, Warner and McCrodan (2011) estimated that sound levels generated by the vessel during dynamic positioning would fall below 170 dB re 1 μPa at 3 feet (1 meter) from the vessel. Noise associated with survey ROVs equipped with acoustic imaging equipment was previously evaluated for site characterization surveys in the Lease Area (Equinor 2020), and NMFS (2020a) determined exposure to disturbing levels of sound due to operation of the survey ROV was extremely unlikely to occur. Sound levels produced by the suction pump are anticipated to fall below ambient noise levels within relatively short distances from the pump (i.e., 1,640 feet [500 meters] (Koschinski and Lüdemann 2020). As described above, the imaging equipment inside the suction bucket would be operated at frequencies at or above 400 kilohertz, and the sector scanning sonar would be operated at frequencies at or above 300 kilohertz; noise produced at these frequencies would be inaudible to marine organisms. Therefore, imaging equipment noise and sector scanning sonar noise do not have the potential to affect ESA-listed species in the action area.

<u>Marine Mammals</u>

Vessel noise overlaps with the hearing range of marine mammals and may cause behavioral responses (e.g., startle responses, behavioral changes, and avoidance), stress responses, and masking (Erbe et al. 2018, 2019; Nowacek et al. 2007; Southall et al. 2007). In NARW, vessel noise is known to increase stress hormone levels, which may contribute to suppressed immunity and reduced reproductive rates and fecundity (Hatch et al. 2012; Rolland et al. 2012). Masking may interfere with detection of prey and predators and reduce communication distances. Modeling results indicate that vessel noise has the potential to substantially reduce communication distances for NARWs (Hatch et al. 2012). As noted above, noise associated with survey ROVs equipped with acoustic imaging equipment was previously evaluated for site characterization surveys in the Lease Area (Equinor 2020). NMFS (2020) determined that the likelihood of marine mammal take resulting from operation of the survey ROV was so low as to be discountable. Therefore, operation of the ROVs under the Proposed Action, which would not utilize acoustic imaging equipment, is not expected to result in behavioral disturbance of marine mammals. Suction pump noise is not anticipated to exceed injury thresholds for marine mammals, but source levels may exceed the 120 dB re 1 µPa behavioral disturbance threshold for non-impulsive noise (Koschinski and Lüdemann 2020). If source levels exceed the behavioral disturbance threshold, sound levels would be expected to attenuate to non-disturbing levels within a relatively short distance (i.e., 1,640 feet [500 meters]). Noise produced during foundation testing is not expected to exceed injury thresholds for marine mammals but could exceed the behavioral disturbance threshold. Short-term, localized behavioral responses may occur, but these responses would dissipate once the test is complete and the vessel or marine mammal leaves the area. Given the temporary nature of the effects, the short duration of individual tests (i.e., up to 9 hours), and the short overall duration of foundation testing (i.e., up to 15 days), any effects of behavioral disturbance on fin whale, NARW, sei whale, or sperm whale due to noise associated with foundation testing would be too small to be meaningfully measured, detected, or evaluated and would therefore be *insignificant*.

When this project is completed, it will not result in underwater noise in the action area, and thus, there would be no underwater noise impacts in the future. We have also considered the likelihood that underwater noise associated with the proposed project would generally increase behavioral disturbance of marine mammals in the action area, in addition to baseline conditions. The proposed project would temporarily generate low levels of noise that may be audible to marine mammals. Given the short duration of activities and relatively low source levels compared to existing anthropogenic noise sources in the action area, the effects of underwater noise would be too small to be meaningfully measured, detected, or evaluated and would therefore be *insignificant*.

Sea Turtles

Based on anticipated sound levels for vessels, noise from the foundation testing vessel may elicit behavioral responses in sea turtles, including startle responses and changes in diving patterns, or a temporary stress response (NSF and USGS 2011; Samuel et al. 2005). As noted above, noise associated with survey ROVs equipped with acoustic imaging equipment was previously evaluated for site characterization surveys in the Lease Area (Equinor 2020). NMFS (2020) determined that the likelihood of behavioral disturbance of marine mammals resulting from operation of the survey ROV was so low as to be discountable. As marine mammals have a lower behavioral disturbance threshold than sea turtles, operation of the ROVs under the Proposed Action, which would not utilize acoustic imaging equipment, is not expected to result in behavioral disturbance of sea turtles. Suction pump noise is not anticipated to exceed the injury threshold or the 175 dB re 1 µPa behavioral disturbance threshold for sea turtles (Koschinski and Lüdemann 2020). Any behavioral responses to foundation testing noise would be short-term and localized to the area around the testing site or the transiting foundation testing vessel; effects of any elicited behavioral response would dissipate once the test is complete and the vessel or sea turtle leaves the area. Given the temporary nature of the effects, the short duration of individual tests, and the short overall duration of foundation testing, any effects of behavioral disturbance on green, Kemp's ridley, leatherback, or loggerhead sea turtles due to noise associated with foundation testing would be too small to be meaningfully measured, detected, or evaluated and would therefore be *insignificant*.

When this project is completed, it will not result in underwater noise in the action area, and thus, there would be no underwater noise impacts in the future. We have also considered the likelihood that underwater noise associated with the proposed project would generally increase behavioral disturbance of sea turtles in the action area, in addition to baseline conditions. The proposed project would temporarily generate low levels of noise. Given the short duration of activities and relatively low source levels compared to existing anthropogenic noise sources in the action area, the effects of underwater noise would be too small to be meaningfully measured, detected, or evaluated and would therefore be *insignificant*.

<u>Fish</u>
Continuous sounds produced by marine vessels have been reported to change fish behavior, causing fish to change swimming speed, direction, or depth in the water column; induce avoidance of affected areas by fish; or alter schooling behavior (De Robertis and Handegard 2013; Engås et al. 1995, 1998; Misund and Aglen 1992; Mitson and Knudsen 2003; Sand et al. 2008; Sarà et al. 2007). It is possible that vessel noise could elicit behavioral responses in Atlantic sturgeon, but these responses would be temporary with effects dissipating once the vessel or sturgeon has left the area. As noted above, ROVs are not anticipated to generate significant levels of underwater noise and are not expected to disturb marine life (Equinor 2020; NMFS 2020). Suction pump noise is not anticipated to exceed the 150 dB re 1 μPa behavioral disturbance threshold for Atlantic sturgeon (Koschinski and Lüdemann 2020). If behavioral effects were to occur, they would be temporary and localized and are expected to be too small to be meaningfully measured, detected, or evaluated and would therefore be *insignificant*.

When this project is completed, it will not result in underwater noise in the action area, and thus, there would be no underwater noise impacts in the future. We have also considered the likelihood that underwater noise associated with the proposed project would generally increase behavioral disturbance of fish in the action area, in addition to baseline conditions. The proposed project would temporarily generate low levels of noise. Given the short duration of activities and relatively low source levels compared to existing anthropogenic noise sources in the action area, the effects of underwater noise would be too small to be meaningfully measured, detected, or evaluated and would therefore be *insignificant*.

Vessel Traffic
A single vessel would be utilized during the proposed foundation testing. As the vessel is expected to exceed 65 feet (20 meters) in length, the foundation testing vessel would be subject to a 10-knot (18.5-kilometer per hour) speed restriction from November 1 through July 31. If the proposed foundation testing were to take place outside of the November-July time period, the foundation testing vessel would comply with any Dynamic Management Area or Slow Zone in effect during foundation testing activities. As summarized in the *Proposed Project* section above, the vessel would also comply with additional measures to minimize vessel interactions with protected species described in *Project Design Criteria and Best Management Practices for Protected Species Associated with Offshore Wind Data Collection* (BOEM 2021), including the following:

- The vessel captain and crew will maintain a vigilant watch for all protected species and reduce speed, stop the vessel, or alter course, as appropriate, to avoid striking any listed species;
- Anytime the vessel is underway, the vessel will maintain a 1,640-foot (500-meter) separation distance from ESA-listed species, including unidentified large whales, and a

trained lookout will monitor a Vessel Strike Avoidance Zone of at least 1,640 feet (500 meters);

- If the trained lookout is a vessel crew member, this will be their designated role and primary responsibility, and they will receive training on protected species identification, vessel strike minimization procedures, how and when to communicate with the vessel captain, and reporting requirements;
- All vessel crew members will be briefed in the identification of protected species that may occur in the action area and in regulations and best practices for avoiding vessel collisions. Reference materials for identification of ESA-listed species will be available on board the vessel, and Beacon Wind will clearly communicate, and post in highly visible locations, the expectation and process for reporting of protected species sightings;
- If an ESA-listed whale or unidentified large whale is observed within 1,640 feet (500 meters) of the forward path of the vessel, the operator will steer a course away from the whale at 10 knots (18.5 kilometers per hour) or less until the 1,640-foot (500-meter) minimum separation distance has been established. The vessel operator may also shift to idle if feasible;
- If a large whale is sighted within 656 feet (200 meters) of the forward path of a vessel, the vessel operator will reduce speed and shift the engine to neutral. Engines will not be engaged until the whale has moved outside of the vessel's path and beyond 1,640 feet (500 meters). If stationary, the vessel will not engage engines until the large whale has moved beyond 1,640 feet (500 meters);
- If a sea turtle of manta ray is sighted at any distance within the operating vessel's forward path, the vessel operator will slow down to 4 knots (7.4 kilometers per hour) and steer away (unless unsafe to do so). The vessel may resume normal vessel operations once the vessel has passed the individual;
- During times of year when sea turtles are known to occur in the action area, the vessel will avoid transiting through areas of visible jellyfish aggregations or floating vegetation (e.g., sargassum lines or mats). In the event that operational safety prevents avoidance of such areas, the vessel will slow to 4 knots (7.4 kilometers per hour) while transiting through such areas;
- A trained lookout will be posted during all times to avoid interactions with ESA-listed species when a vessel is underway (transiting or surveying) by monitoring in all directions; during any nighttime transits, the lookout will be equipped with night vision and/or infrared equipment to aid in detection of ESA-listed species;
- All crew members responsible for navigation duties will receive site-specific training on ESA-listed species sighting/reporting and vessel strike avoidance measures;
- The vessel will not divert course to approach any ESA-listed species or other marine mammal species;
- The vessel will reduce speed to 10 knots (18.5 kilometers per hour) or less while operating in any Slow Zone, except in areas within a portion of a visually designated Dynamic Management Area or Slow Zone where it is not reasonable to expect the presence of NARWs (e.g., Long Island Sound, shallow harbors); and
- The vessel operator will check for information regarding mandatory or voluntary ship strike avoidance (Seasonal Management Areas and Dynamic Management Areas [or Slow Zones that are also designated as Dynamic Management Areas]) and daily information regarding NARW sighting locations. These media may include, but are not

limited to: NOAA weather radio, U.S. Coast Guard NAVTEX and channel 16 broadcasts, Notices to Mariners, the Whale Alert app, or WhaleMap website.

Marine Mammals

Vessel strikes are a major source of mortality and injury for many marine mammal species (Hayes et al. 2021; Laist et al. 2001; Moore and Clarke 2002), including NARW (Kite-Powell et al. 2007). Almost all sizes and classes of vessels have been involved in collisions with marine mammals around the world (Dolman et al. 2006). Marine mammals are expected to be most vulnerable to vessel strikes when within the vessel's draft and not detectable by visual observers (e.g., animal below the surface or poor visibility conditions such as bad weather or low light), and probability of vessel strike increases with increasing vessel speed (Pace and Silber 2005; Vanderlaan and Taggart 2007). NARWs are at highest risk for vessel strike when vessels travel in excess of 10 knots (Vanderlaan and Taggart 2007); serious injury to cetaceans due to vessel collision rarely occurs when vessels travel below 10 knots (Laist et al. 2001). Given that a single vessel will be used for the proposed foundation testing and the mitigation measures to avoid vessel strike described above, including vessel speed restrictions, use of trained lookouts, minimum separation distances, and vessel strike avoidance procedures, a collision between the vessel and an ESA-listed marine mammal is extremely unlikely to occur. Therefore, the effects of vessel traffic on fin whale, NARW, sei whale, and sperm whale are expected to be *discountable.*

When this project is completed, it will not result in an increased number of vessels in the action area, and thus, there is no increased risk of vessel strike in the future. We have also considered the likelihood that an increase in vessel traffic related to the activities associated with the proposed project would generally increase the risk of interactions between marine mammals and vessels in the action area, in addition to baseline conditions. The use of the single foundation testing vessel would cause a small, localized, temporary increase in vessel traffic. Given the extremely small increase in vessel traffic above existing levels in action area and the mitigation measures proposed, vessel strikes are extremely unlikely to occur, and effects to marine mammals would be *discountable*.

Sea Turtles

Vessel strikes are a known source of injury and mortality for sea turtles (Chaloupka et al. 2008). Though sea turtles spend a majority of their time (greater than 90 percent) submerged (Lutcavage and Lutz 1997), most of their submerged time (60 to 75 percent) occurs within 32 feet (10 meters) of the surface for hard-shelled species (i.e., green, Kemp's ridley, and loggerhead sea turtles) (Borcuk et al. 2017; Watwood and Buonantony 2012), indicating that these species may be vulnerable to vessel strike, particularly by deep draft vessels, approximately 66 to 81 percent of the time. Leatherback sea turtles spend less time within 32 feet (10 meters) of the surface (approximately 20 percent) (Borcuk et al. 2017; Watwood and Buonantony 2012), indicating that this species may be less vulnerable to vessel strike that the other sea turtle species in the action area. Sea turtles are expected to be most vulnerable to vessel strikes in coastal foraging areas and may not be able to avoid collisions when vessel speeds exceed 2 knots (4 kilometers per hour) (Hazel et al. 2007). Given that a single vessel will be used for the proposed Foundation Testing and the mitigation measures to avoid vessel strike described above, including use of trained lookouts, minimum separation distances, and vessel strike avoidance procedures, a collision between the vessel and a sea turtle is extremely unlikely to occur. Therefore, the effects of vessel traffic on green, Kemp's ridley, leatherback, and loggerhead sea turtle are expected to be *discountable.*

When this project is completed, it will not result in an increased number of vessels in the action area, and thus, there is no increased risk of vessel strike in the future. We have also considered the likelihood that an increase in vessel traffic related to the activities associated with the proposed project would generally increase the risk of interactions between sea turtles and vessels in the action area, in addition to baseline conditions. The use of the single foundation testing vessel would cause a small, localized, temporary increase in vessel traffic. Given the extremely small increase in vessel traffic above existing levels in action area and the mitigation measures proposed, vessel strikes are extremely unlikely to occur, and effects to sea turtles would be *discountable*.

<u>Fish</u>

Vessel strikes are a documented source of mortality for Atlantic sturgeon in riverine habitats (Balazik et al. 2012; Brown and Murphy 2010; Krebs et al. 2019). In the marine environment, where the foundation testing vessel will be operating, demersal Atlantic sturgeon would have much more separation from vessel hulls due to deeper water and less constrained ability to avoid vessels (i.e., as opposed to within the narrow confines of a shallower river); therefore, the risk of vessel strike may be significantly lower compared to the estuarine/riverine environment. Given that a single vessel will be used for the proposed foundation testing and the demersal nature of Atlantic sturgeon, a collision between the vessel and an Atlantic sturgeon is extremely unlikely to occur. Therefore, the effects of vessel traffic on Atlantic sturgeon are expected to be *discountable*.

When this project is completed, it will not result in an increased number of vessels in the action area, and thus, there is no increased risk of vessel strike in the future. We have also considered the likelihood that an increase in vessel traffic related to the activities associated with the proposed project would generally increase the risk of interactions between Atlantic sturgeon and vessels in the action area, in addition to baseline conditions. The use of the single foundation testing vessel would cause a small, localized, temporary increase in vessel traffic. Given the extremely small increase in vessel traffic above existing levels in action area and the anticipated location of sturgeon in the water column, vessel strikes are extremely unlikely to occur, and effects to Atlantic sturgeon would be *discountable*.

Physical Interactions with Foundation Testing Equipment

There is the potential for the frame or suction bucket to come into contact with an ESA-listed species while being lowered. However, the structures would be lowered at a low speed (0.7 miles per hour [1.1 kilometers per hour]) and in a controlled manner. In the unlikely event that weather conditions make onboarding the suction bucket at the end of the test hazardous, the suction bucket may be suspended under the vessel as it transits to the next testing site, as described above, posing an opportunity for potential physical interactions with ESA-listed species during transit. However, the transit would be conducted at low speed (i.e., 1 to 2 knots [2 to 4 kilometers per hour]). There is also the potential for interactions with operating ROVs or acoustic moorings being deployed.

Marine Mammals
An ESA-listed marine mammal would have to be directly below the suction bucket, reference frame, or acoustic mooring as it is being lowered or in the water column immediately in front of the operating ROV or the suction bucket during vessel transit to experience a physical interaction during movement of foundation testing equipment. Additionally, the rate of lowering the bucket and frame (i.e., 13 inches [33 centimeters] per second) at each testing site and the slow transit speed during suspended transit of the suction bucket should allow marine mammals to avoid interaction. Additionally, BOEM would require that no lowering or retrieval of the suction bucket be permitted if any listed species are sighted within 1,640 feet (500 meters) of the installation vessel. Based on this information and the relatively small number of tests for proposed foundation testing, physical interactions between fin whale, NARW, sei whale, or sperm whale and foundation testing equipment are extremely unlikely to occur and would therefore be *discountable*.

When this project is completed, it will not result in an increased risk of physical interactions in the future. We have also considered the likelihood that an increase in physical interaction risk related to the activities associated with the proposed project would generally increase the risk of interactions with marine mammals in the action area, in addition to baseline conditions. The lowering of the suction bucket and reference frame and the potential suspended transit of the suction bucket could potentially result in physical interactions. Given the slow lowering and suspended transit speeds and the mitigation measure prohibiting the lowering of equipment when ESA-listed species are withing 1,640 feet (500 meters) of the foundation testing vessel, physical interactions are extremely unlikely to occur, and effects to marine mammals would be *discountable*.

Sea Turtles
A sea turtle would have to be directly below the suction bucket, reference frame, or acoustic mooring as it is being lowered or in the water column immediately in front of the operating ROV or the suction bucket during vessel transit to experience a physical interaction during movement of foundation testing equipment. Additionally, the slow rate of lowering the bucket and frame at each testing site and the slow transit speed during suspended transit of the suction bucket should allow sea turtles to avoid interaction. Additionally, BOEM would require that no lowering or retrieval of the suction bucket be permitted if any listed species are sighted within 1,640 feet (500 meters) of the foundation testing vessel. Based on this information and the relatively small number of tests for proposed Foundation Testing, physical interactions between green, Kemp's ridley, leatherback, and loggerhead sea turtles and foundation testing equipment are extremely unlikely to occur and would therefore be *discountable*.

When this project is completed, it will not result in an increased risk of physical interactions in the future. We have also considered the likelihood that an increase in physical interaction risk related to the activities associated with the proposed project would generally increase the risk of interactions with sea turtles in the action area, in addition to baseline conditions. The lowering of the suction bucket and reference frame and the potential suspended transit of the suction bucket could potentially result in physical interactions. Given the slow lowering and suspended transit speeds and the mitigation measure prohibiting the lowering of equipment when ESA-listed species are withing 1,640 feet (500 meters) of the foundation testing vessel, physical interactions are extremely unlikely to occur, and effects to sea turtles would be *discountable*.

Fish

An Atlantic sturgeon would have to be on the seabed directly below the suction bucket, reference frame, or acoustic mooring as it is being lowered or in the water column immediately in front of the operating ROV or the suction bucket during vessel transit to experience a physical interaction with foundation testing equipment. Additionally, the slow rate of lowering should allow Atlantic sturgeon to avoid interaction. As suspended transit of the suction bucket would occur in the water column, Atlantic sturgeon are not expected to be vulnerable to physical interactions during suction bucket movement in inclement weather conditions. Based on this information and the relatively small number of tests for proposed foundation testing, physical interactions between Atlantic sturgeon and foundation testing equipment are extremely unlikely to occur and would therefore be *discountable*.

When this project is completed, it will not result in an increased risk of physical interactions in the future. We have also considered the likelihood that an increase in physical interaction risk related to the activities associated with the proposed project would generally increase the risk of interactions with Atlantic sturgeon in the action area, in addition to baseline conditions. The lowering of the suction bucket and reference frame could potentially result in physical interactions. Given the slow lowering speed, physical interactions are extremely unlikely to occur, and effects to Atlantic sturgeon would be *discountable*.

North Atlantic Right Whale Critical Habitat

As stated above, the foundation testing vessel would likely transit through the southern edge of NARW critical habitat Unit 1 when traveling between its origin/destination port in Europe and the mobilization/demobilization port(s) for the proposed project, resulting in up to two one-way transits through designated critical habitat. Vessel transits would not affect the physical and biological features of designated critical habitat for NARW foraging, including *C. finmarchicus* aggregations or the physical conditions or structures that distribute or aggregate *C. finmarchicus*. An accidental release from the vessel could potentially affect *C. finmarchicus* aggregations. However, such a release is extremely unlikely to occur. Therefore, effects of the proposed project on designated critical habitat for NARW would be *discountable*.

Conclusions

Based on the analysis that all effects of the proposed action will be insignificant and/or discountable (i.e., extremely unlikely to occur), we have determined that approval of Beacon Wind's SAP amendment, which would authorize foundation testing in the Lease Area, may affect, but is not likely to adversely affect any listed species under NOAA Fisheries' jurisdiction. We certify that we have used the best scientific and commercial data available to complete this analysis.

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